

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
CONTRACT ADMINISTRATION DIVISION

MATERIALS PROCEDURE

PROCEDURE FOR EVALUATING QUALITY CONTROL SAMPLE TEST
RESULTS WITH VERIFICATION SAMPLE TEST RESULTS

- 1.0 PURPOSE
 - 1.1 To provide a procedure for the comparison of quality control sample test results with verification sample test results.
- 2.0 SCOPE
 - 2.1 This procedure is primarily applicable to the contractor's test results when used in the acceptance process. Other tests, not necessarily applicable to the acceptance process but used for control of materials, may also apply.
 - 2.2 Materials and Tests
 - 2.2.1 Aggregate Gradations
 - 2.2.2 Hot Mix Asphalt
 - 1. Asphalt Content
 - 2. Air Voids
 - 3. Stability
 - 4. Flow
 - 2.2.3 Portland Cement Concrete
 - 1. Air Content
 - 2. Consistency
- 3.0 PROCEDURE
 - 3.1 The following procedure will be implemented by the District Materials Engineer/Supervisor.

- 3.2 Immediately after completion of the verification sample, it will be compared to applicable quality control sample test results for the same item. Note that all samples being compared must be taken from the same sampling location, e.g., stockpile, roadway, etc., and sampled and tested in the same manner. The comparison will be made in the following manner (also see sample computation sheets in the attachments).
- 3.2.1 If there are more than ten quality control samples available, determine the average of the ten consecutive quality control samples (\bar{X}_{10}) whose midpoint is nearest chronologically to the verification sample. Should there only be five to ten quality control samples available, determine the average of all the available consecutive quality control test results. When comparing the grading characteristics of an aggregate, the average (\bar{X}) for each sieve will be determined.
- 3.2.2 In the event there are less than five quality control samples available when the verification sample is complete, the District Materials Engineer/Supervisor will make an informal review of the data. If the data is such that a dissimilarity appears obvious (even without a formal comparison) then Section 4.1 of this procedure would apply. If, however, the verification sample results appear to be similar to the quality control sample results then the verification sample would be judged at this point by the District Materials Engineer/Supervisor to be similar, and the applicable portions of Section 5.1 of this procedure would apply with the following statement: "This verification sample (verification sample number recorded here) has been judged to be similar in accordance with Section 3.2.2 of MP 700.00.54."
- 3.2.3 Determine the range (R) of the quality control samples used in Section 3.2.1 by subtracting the smallest test value from the largest test value. When comparing the grading characteristics of aggregate, the range (R) for each sieve will be determined.
- 3.2.4 Compute the interval (I) by substituting the values calculated in Sections 3.2.1 and 3.2.3 into the proper equation below. When comparing the grading

characteristics of aggregate, the interval(I) for each sieve will be determined.

No. of Samples Used in
Calculating the Average
in Section 3.2.1

Equation for Computing
the Interval (I)

10	$I = X(\bar{)}_{10} + 0.91R$
9	$I = X(\bar{)}_9 + 0.97R$
8	$I = X(\bar{)}_8 + 1.05R$
7	$I = X(\bar{)}_7 + 1.17R$
6	$I = X(\bar{)}_6 + 1.33R$
5	$I = X(\bar{)}_5 + 1.61R$

- 3.2.5 The interval(I) is determined by first adding the average ($X(\bar{)}_n$) to the product of the range (R) times the given constant (This determines the upper limit of the interval). Note that for gradings, if the result obtained is greater than 100, it will be recorded as 100. And second, subtract the product of the range (R) times the given constant from the average ($X(\bar{)}_n$). This determines the lower limit of the interval. Note here that if the result is less than zero, it will be recorded as zero.
- 3.2.6 Compare the verification sample test result with the calculated interval. When comparing the grading characteristics of aggregates, a comparison for each sieve will be determined.
- 3.3 If the verification sample is an aggregate and all sieve results coincide with or lie between the upper and lower limits of the interval, the quality control sample test results will be considered similar to the verification sample test results.
- 3.4 If the verification sample is an aggregate and any one of the compared values (on any sieve) is not similar to the quality control data, the quality control samples will be considered dissimilar to the verification sample.
- 3.5 If the verification sample is an asphalt mix, and the asphalt content and air voids coincide with or lie between the upper and lower limits of their interval,

the quality control samples will be considered to be similar to the verification sample.

3.6 If the verification sample is an asphalt mix, and any one of the compared values is not similar to the quality control data, the quality control samples will be considered to be dissimilar to the verification sample.

3.7 If the verification sample (test) is Portland Cement concrete, and both the air content and consistency coincide with or lie between the upper and lower limits of their interval, the quality control samples (tests) will be considered to be similar to the verification sample.

4.0 EVALUATION

4.1 If the quality control sample data is dissimilar to the verification sample the following action will be taken where appropriate.

4.1.1 Review the quality control sampling procedure.

4.1.2 Review the quality control testing procedures.

4.1.3 Check testing equipment

4.1.4 Review computations.

4.1.5 Review documentation.

4.1.6 Perform any additional investigations that may clarify the dissimilarity.

5.0 REPORTING

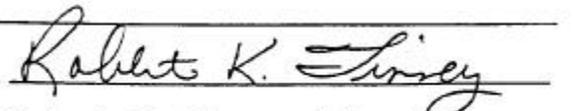
5.1 If the quality control samples are found to be similar to the verification sample, proof of the similarity will be shown on the back of, or attached to, the original verification sample test report. The proof will include all of the calculations specified in Section 3.2.1 through 3.2.6 using the format similar to that shown on the appropriate sample computation sheet (attached). The report should be signed by the District Materials Engineer/Supervisor and distributed as specified in Sections 5.5 and 5.6.

- 5.2 If the quality control samples are dissimilar to the verification sample, the investigation described in Section 4.0 will be documented on the reverse side, or attached to, the original verification sample test report as described below, omitting the words in parenthesis which do not apply. A copy of all calculations specified in Section 3.2.1 to 3.2.6 using the format similar to that shown on the appropriate sample computation sheet will also accompany the test report.
1. Quality control sampling procedures (are, are not) in accordance with applicable directives.
 2. Quality control testing procedures (are, are not) in accordance with applicable directives.
 3. Testing equipment (is, is not) in proper working order.
 4. Computations (are, are not) correctly performed.
 5. Documentation (is, is not) properly performed.
 6. Report any other information that may have been determined in accordance with Section 4.1.6.
- 5.3 All negative replies noted above will be explained. This will include a brief statement of the action taken to correct the deficiency. In the event other documentation is needed, such as a District Materials Inspection Report, to explain and/or support the final resolution of the dissimilarity, the dissimilar verification sample number should be referenced therein.
- 5.4 Results of the investigation as reported will be signed by the District Materials Engineer/Supervisor.
- 5.5 On the test report at the bottom will be typed the following: "Issued by District (Number) per MP 700.00.54, (Date)."
- 5.6 The signed, issued report should be prepared in duplicate and distributed as follows:

MP 700.00.54
REPLACES ML27 AND ML31
ISSUED: JULY 1991
REISSUED: JANUARY 1995
1ST REVISION: JULY 2000
PAGE 6 OF 6

5.6.1 The original copy will be submitted to the Contract Administration Division, Materials Section.

5.6.2 On copy should be maintained in the District Materials file.


Robert K. Tinney, Director
Contract Administration Division

RKT:bk

ATTACHMENTS

MP 700.00.54
 REPLACES ML27 AND ML31
 ISSUED: JULY 1991
 REISSUED: JANUARY 1995
 1ST REVISION: JULY 2000
 ATTACHMENT NO. 1

**COMPUTATION SAMPLE SHEET
 ASPHALT**

Quality Control Lab. Number	Date	Asphalt Content (%)	Air Voids (%)	Stability Newtons)	Flow (0.25mm)
C7-68439	9-15-98	3.8	3.7	9586	11.3
C7-68676	9-16-98	4.3	3.2	9512	9.8
C7-68922	9-16-98	3.5	4.1	9688	10.6
C7-69314	9-17-98	4.0	4.4	9450	11.5
C7-69658	9-17-98	4.2	3.8	9498	10.2
C7-69770	9-18-98	4.0	5.0	9725	9.1
C7-69879	9-22-98	4.0	4.6	9531	10.3
C7-69891	9-22-98	4.0	3.7	9706	11.1
C7-70126	9-23-98	4.5	3.0	9825	11.6
C7-70245	9-24-98	4.3	4.6	9412	10.8

X(bar) = 4.06 4.01 9593.3 10.63

Property	Average X(bar) ₁₀	Constant ± (0.91)	Range x (R)	Interval (I)	V.S. ¹ Result	Similar Yes/No
Asphalt Content	4.06	0.91	1.0	5.0/3.2 ²	4.5	Yes
Air Voids	4.01	0.91	3.0	6.7/1.3 ²	3.9	Yes
Flow	10.63	0.91	2.5	12.9/8.4 ²	10.3	Yes
Stability	9593.3	0.91	413	9969/9217 ³	9650	Yes

Note: All four of these tests may not apply to any one sample. For those tests that do apply and all replies in the "Similar" column are "Yes", take action specified in Section 5.1. If one or more of the applicable test replies in the "Similar" column are "No", take action specified in Section 5.2.

- 1 - Verification Sample.
- 2 - Round calculated intervals to nearest 0.1 percent.
- 3 - Round calculated interval to nearest whole Newton.

MP 700.00.54
 REPLACES ML27 AND ML31
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 ATTACHMENT NO. 2

**COMPUTATION SAMPLE SHEET
 PORTLAND CEMENT CONCRETE**

Quality Control ID or Lab. Number	Date	Air Content (%)	Consistency (Slump) (inches)
01	9-15-98	6.2	2.50
02	9-16-98	7.0	2.75
03	9-16-98	5.2	2.50
04	9-17-98	6.4	3.00
05	9-17-98	5.0	2.75
06	9-18-98	5.8	2.25
07	9-22-98	5.4	2.50
08	9-22-98	4.4	2.75
09	9-23-98	6.0	3.00
10	9-24-98	6.0	2.50

X(bar) = 5.74 2.65

Property	Average X(bar) ₁₀ ±	Constant (0.91)	Range (R)	Interval (I)	V.S. ¹ Result	Similar Yes/No
Air Content	5.74	0.91	2.6	8.1/3.4 ²	7.6	Yes
Consistency (Slump)	2.65	0.91	0.75	3.25/2.00 ³	3.00	Yes

Note: If all replies in the "Similar" column are "Yes", take action Specified in Section 5.1. If one or both of the replies in the "Similar" column are "No", take action specified in Section 5.2.

- 1 - Verification Sample
- 2 - Round calculated interval to nearest 0.1 percent.
- 3 - Round calculated interval to nearest 0.25 inches.

MP 700.00.54
 REPLACES ML27 AND ML31
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 ATTACHMENT NO. 3

**COMPUTATION SAMPLE SHEET
 AGGREGATE GRADATIONS**

Quality Control								
Lab. Number	Date	1 ½"	1"	½"	#4	#8	#200	
C7-57698	08-10-98	100	100	25	4	2	0.6	
C7-57972	08-10-98	100	100	30	2	2	0.6	
C7-58793	08-11-98	100	99	28	2	1	0.4	
C7-58845	08-11-98	100	99	49	8	2	1.0	
C7-76068	08-12-98	100	100	32	2	1	0.5	
C7-76271	08-12-98	100	100	36	1	1	0.6	
C7-78174	08-13-98	100	100	42	2	2	0.7	
C7-78232	08-13-98	100	100	19	1	1	0.5	
C7-78496	08-14-98	100	100	36	2	2	0.3	
C7-78541	08-15-98	100	100	43	1	1	0.5	
X(bar)		=	100	99.8	34.0	2.5	1.5	0.57

Sieve Size	Average X(bar) ₁₀ ±	Constant (0.91)	Range x (R)	Interval (I)	V.S.* Result	Similar Yes/No
1 ½"	100	0.91	0	100/100	100	Yes
1"	99.8	0.91	1	100/99	100	Yes
½"	34.0	0.91	30	61/7	24	Yes
#4	2.5	0.91	7	9/0	2	Yes
#8	1.5	0.91	1	2/0	1	Yes
#200	0.57	0.91	0.7	1.2/0	0.4	Yes

Note: If all replies in the "Similar" column are "Yes", take action Specified in Section 5.1. If one or more of the replies in this column are "No", take action specified in Section 5.2.

All calculated intervals are to be rounded to the nearest whole number except the #200 sieve which is rounded to the nearest 0.1.

* Verification Sample